

Pending Claims:

These claims were previously submitted by Amendment on June 17, 2003.

1. (Previously presented) A catalyst composition suitable for use as a catalyst for the preparation of an ester comprising
 - (a) an organometallic compound which is the reaction product of
 - (i) an orthoester or condensed orthoester of at least one metal selected from the group consisting of titanium, zirconium and aluminum,
 - (ii) an alcohol containing at least two hydroxyl groups,
 - (iii) an organophosphorus compound containing at least one P-OH group, and
 - (iv) optionally, a base, wherein, when said base is used, it is selected from the group consisting of inorganic bases, quaternary ammonium compounds, monoethanolamine and diethanolamine; and
 - (b) at least one compound of germanium, antimony or tin.
2. (Previously presented) A catalyst composition according to claim 1, wherein the organometallic compound comprises the reaction product of an orthoester or condensed orthoester of at least one metal selected from the group consisting of titanium, zirconium and aluminum, an alcohol containing at least two hydroxyl groups, and an organophosphorus compound containing at least one P-OH group, and said base.
3. (Previously presented) A catalyst composition according to claim 1, wherein the organometallic compound comprises the reaction product of an orthoester or condensed orthoester of at least one metal selected from the group consisting of titanium, zirconium and aluminum, an alcohol containing at least two hydroxyl groups, an organophosphorus compound containing at least one P-OH group, a said base and (v) a 2-hydroxy carboxylic acid.
4. (Previously presented) A catalyst composition according to claim 3, wherein the 2-hydroxy acid is lactic acid, citric acid, malic acid or tartaric acid or a phosphorus derivative of at least one of said acids.

5. (Previously presented) A catalyst composition according to claim 1, wherein the orthoester has the formula $M(OR)_4$ and/or $Al(OR)_3$ wherein M is titanium and/or zirconium and R is an alkyl group containing from 1 to 6 carbon atoms.

6. (Previously presented) A catalyst composition according to claim 1, wherein the condensed orthoester has a structure which can be represented by the formula, $R^1O[M(OR^1)_2O]R_n^1$ where M is titanium and/or zirconium, R^1 is an alkyl group containing 1 to 6 carbon atoms and n is less than 20.

7. (Previously presented) A catalyst composition according to claim 1, wherein the alcohol containing at least two hydroxyl groups is 1,2-ethanediol, 1,2-propanediol, 1,3-propanediol, 1,4-butanediol, 2-methyl-2,4-pentanediol, diethylene glycol, polyethylene glycol, glycerol, trimethylolpropane, pentaerythritol or 1,6 cyclohexane dimethanol.

8. (Previously presented) A catalyst composition according to claim 1, wherein the organometallic compound is prepared by reacting a dihydric alcohol with an orthoester or condensed orthoester in a ratio of from 1 to 32 moles of dihydric alcohol to each mole of titanium, zirconium or aluminum.

9. (Previously presented) A catalyst composition according to claim 1, wherein the organophosphorus compound is a phosphate, a pyrophosphate, a phosphonate, a phosphinate, a phosphite or a salt of a phosphate or phosphonate or a phosphorous derivative of a hydroxy acid.

10. (Previously presented) A catalyst composition according to claim 9, wherein the organophosphorous compound is a substituted or unsubstituted alkyl phosphate, a substituted or unsubstituted aryl phosphate, a salt of an alkyl or aryl phosphonate, a phosphate of an alkylaryl glycol ether or an alkyl glycol ether, or a product obtainable by reaction of phosphorus pentoxide with a polyhydric alcohol.

11. (Previously presented) A catalyst composition according to claim 10, wherein the organophosphorus compound is an alkyl phosphate in which the organic group contains up to 20 carbon atoms.

12. (Previously presented) A catalyst composition according to claim 10, wherein the organophosphorus compound is a phosphate of an alkylaryl glycol ether or an alkyl glycol ether having a carbon chain length up to 18 carbon atoms.

13. (Previously presented) A catalyst composition according to claim 10, wherein the organophosphorus compound is a reaction product of phosphorus pentoxide and a polyhydric alcohol in which the molar ratio of polyhydric alcohol to P is up to 50:1.

14. (Previously presented) A catalyst composition according to claim 9, wherein the organophosphorus compound is a phosphorous derivative of a hydroxy acid.

15. (Previously presented) A catalyst composition according to claim 1, wherein the organophosphorus compound is present in the organometallic compound in an amount in the range 0.1 to 4.0 mole of phosphorus to 1 mole of titanium, zirconium or aluminum.

16. (Previously presented) A catalyst composition according to claim 1, wherein a said base is present in the organometallic compound in an amount in the range 0.01 to 4.0 mole of base to 1 mole of titanium, zirconium or aluminum.

17. (Previously presented) A catalyst composition according to claim 3, wherein the 2-hydroxy acid is present in the organometallic compound in an amount in the range 0.1 to 4 mole acid to 1 mole of titanium, zirconium or aluminum.

18. (Previously presented) A catalyst composition according to claim 1, wherein the compound of germanium is present and is germanium dioxide or a salt of germanium.

19. (Previously presented) A catalyst composition according to claim 1, wherein the compound of antimony is present and is antimony trioxide or a salt of antimony.

20. (Previously presented) A catalyst composition according to claim 1, wherein the compound of tin is present and is a tin salt, a dialkyl tin oxide, a dialkyl tin dialkanoate or an alkylstannoic acid.

21. (Previously presented) A catalyst composition according to claim 1, wherein the molar ratio of the organometallic compound to the compound of germanium, antimony or tin is in the range 9:1 to 1:9 calculated as moles of Ti, Zr or Al to moles of Ge, Sb or Sn.

22. (Previously presented) A process for the preparation of an ester comprising carrying out an esterification reaction in the presence of a catalyst comprising the catalyst according to claim 1.

23. (Previously presented) A process according to claim 22, wherein the esterification reaction comprises reaction of an alcohol with stearic acid, isostearic acid, capric acid, caproic acid, palmitic acid, oleic acid, palmitoleic acid, triacontanoic acid, benzoic acid, methyl benzoic acid, salicylic acid, a rosin acid, abietic acid, phthalic acid, isophthalic acid, terephthalic acid, sebamic acid, adipic acid, azelaic acid, succinic acid, fumaric acid, maleic acid, naphthalene dicarboxylic acid, pamoic acid, trimellitic acid, citric acid, trimesic acid or pyromellitic acid.

24. (Previously presented) A process according to claim 22, wherein the esterification reaction comprises a reaction of an alcohol with an anhydride of a dicarboxylic acid or a tricarboxylic acid.

25. (Previously presented) A process according to claim 22, wherein the esterification reaction comprises reaction of a methyl ester, an ethyl ester or a propyl ester of acrylic acid or methacrylic acid with an alcohol.

26. (Previously presented) A process according to claim 22, wherein the esterification reaction comprises reaction of two esters to produce two different esters by exchange of alkoxy groups.

27. (Previously presented) A process according to claim 22, wherein the esterification reaction comprises a polyesterification comprising the reaction of terephthalic acid, dimethyl terephthalate, dimethyl naphthalenate or naphthalene dicarboxylic acid with 1,2-ethanediol, 1,4-butanediol, 1,3-propanediol, 1,6 cyclohexane dimethanol, trimethylolpropane or pentaerythritol.

28. (Previously presented) A process according to claim 22, wherein the catalyst is present in an amount in the range 10 to 1200 parts per million calculated as parts by weight of total metal (Ti, Zr or Al plus Ge, Sb or Sn) with respect to weight of product ester.

29. (Previously presented) A process according to claim 22 or 27, wherein the esterification reaction is a polyesterification and the catalyst is present in an amount in the range 5 to 550 parts per million calculated as parts by weight total metal (Ti, Zr or Al plus Ge, Sb or Sn) with respect to weight of product polyester.

30. (Previously presented) A process according to claim 22, wherein the total amount of titanium, zirconium or aluminum present is in the range 5 to 500 parts per million calculated as parts by weight of Ti, Zr or Al with respect to weight of product ester and the total amount of germanium, antimony or tin present is in the range 5 to 700 ppm calculated as Ge, Sb or Sn with respect to product ester.

31. (Previously presented) A process according to claim 22, wherein the total amount of titanium, zirconium or aluminum present is in the range 3 to 250 parts per million calculated as parts by weight of Ti, Zr or Al with respect to weight of product polyester and the total amount of germanium, antimony or tin present is in the range 3 to 300 ppm calculated as Ge, Sb or Sn with respect to product polyester.

32. (Original) A polyester comprising the residues of a reaction between a polybasic acid or ester thereof with a polyhydric alcohol and further containing residues of a catalyst system comprising:

- (a) the reaction product of an orthoester or condensed orthoester of at least one metal selected from titanium, zirconium or aluminium, an alcohol containing at least two hydroxyl groups and an organophosphorus compound containing at least one P-OH group, and
- (b) at least one compound of germanium, antimony or tin.

33. (Previously presented) The catalyst composition of claim 1 wherein said reaction product is obtained by mixing the orthoester or condensed orthoester and a dihydric alcohol; and, subsequently, adding a said base, followed by addition of the organophosphorus compound.

34. (Previously presented) The catalyst composition of claim 3 wherein said reaction product is obtained by adding said 2-hydroxy carboxylic acid to said orthoester or condensed orthoester before said organophosphorus compound is added.

35. (Previously presented) The catalyst composition of claim 3 wherein at least a portion of said 2-hydroxy carboxylic acid is neutralized with at least a part of said base and the resulting salt is added to the other components of the reaction mixture.